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The Effect of Reported Head Injury on Team Performance and Partner Evaluation

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Introduction

In a Report to Congress released in February 2014, the Defense and Veterans Brain Injury Center reported 287,911 Service Members (deployed and not previously deployed) with traumatic brain injury (TBI) from years 2000 to 2013 (U.S. Congressional Research Service). Of all the Service Members that have deployed to Iraq, it is estimated that 23 percent have experienced a TBI during deployment as a result of different types of head injuries (Hoge et al., 2008; MacGregor et al., 2010; Terrio et al., 2009). Researchers have indicated that mild TBI (mTBI) typically results from blunt trauma created by a blow to the head or an object penetrating the skull. Symptoms associated with mTBI include neuropsychological difficulties (such as issues with concentration, attention, memory, mood, and anxiety) that last from a few days to six months (Hanna-Pladdy et al., 2001; Management of Concussion/ head injury Working Group, 2009). Service Members that complete treatment programs such as the National Intrepid Center of Excellence – Intrepid Spirit III (NICOE-ISIII) at Fort Campbell, Kentucky are able to successfully return to active duty at a rate of approximately 77 percent (Quigley, 2009). Despite the availability of effective treatments, research suggests that many of those with mTBI are not likely to seek treatment (Hoge et al., 2008; Tanielian and Jaycox, 2008), and therefore will continue to suffer from mTBI symptoms while serving in military units. However, little research has investigated the perceptions and attitudes held by members of military units toward fellow Soldiers with mTBI. The present study evaluates how knowledge of a partner's prior head injury affects perceptions of the injured individual and how this perception affects team performance.

Background

Although a large amount of recent research has investigated the predictors and outcomes associated with head injury during combat deployments (Hoge et al., 2008; Tanielian and Jaycox, 2008), less work has focused on how military personnel view and interact with fellow personnel who have experienced head injuries. To better understand the effects problems like TBI can have on teamwork and interpersonal evaluations, it is worth highlighting the unique operational environment in which military personnel operate. The military puts a large focus on the importance of teamwork, trust, and operational readiness (Ingraham and Manning, 1981; Manning, 1991). Therefore, military personnel may have concerns about operational readiness as a result of Soldiers experiencing problems such as TBI stemming from head injuries. We first review prior research in the civilian literature on perceptions of individuals with TBI, and discuss one study examining perceptions of military personnel with TBI. Given the lack of research on how individuals act toward others with TBI, we then review research on how individuals act toward others with mental health problems. This section concludes with hypotheses regarding how interacting with a fellow Service Member recovering from a head injury may affect team performance and evaluation of the Service Member.

The limited body of literature on perceptions of individuals with TBI suggests that knowledge or familiarity with issues surrounding the injury can mitigate the negative perceptions held by the public. McLellan, Bishop, and McKinlay (2010) investigated attitudes towards individuals with TBI. Subjects were asked to rate “Tony,” who had sustained a brain injury, and “Peter,” who had sustained a limb-injury, on several characteristics such as sociability, likeableness, maturity,

honesty, etc. Participants were also asked if they were familiar with TBI either personally or by knowing someone with the condition. Tony was rated more negatively than Peter on the majority of the measures. Further, the subjects that indicated a familiarity with TBI gave more positive ratings for Tony than subjects that were unfamiliar with TBI. This gives evidence that negative attitudes held by the public exist for TBI. However, this study also suggests that individuals that are more knowledgeable about TBI tend to be less negative about the condition than those that are unfamiliar.

Ralph and Derbyshire (2013) conducted a systematic review of the literature on public knowledge and attitudes associated with brain injury in the United Kingdom. The findings indicated that the public generally has a lack of awareness of brain injuries. Findings also suggested the public has negative attitudes towards the survivors of brain injury. As the McLellan, Bishop, and McKinlay (2010) study suggested, Ralph and Derbyshire's (2013) research indicated that a lack of familiarity with TBI among the general public may contribute to the negativity held towards those with the injury.

The public may have negative perceptions of individuals with prior head injuries because of the invisibility of the injury (McClure 2011; Meixner, 2013). When an injury is visible, as in a physical injury, the public is aware of the injury and may attribute symptoms displayed by the injured person with the actual injury. In some cases, the public may be more likely to empathize with the injured person, and establish greater familiarity. McClure (2011) utilized the attribution theory to explain public misconceptions of head injury. The author argued people tend to misattribute symptoms related to the head injury to other, more normalized conditions. There were two features to the misattribution: First, there are no visible indications of the injury; and Second, people are more likely to compare individuals with head injury to their peers without considering their pre-injury performance. Meixner (2013) further explained that the public tends to associate symptoms of head injury to the injured person's character instead of the injury. For example, because mTBI is not a visible injury, the general public would likely think of a person displaying symptoms of forgetfulness as unreliable rather than injured.

In the only study we are aware of to examine perceptions of military personnel experiencing mTBI, Britt et al. (2015) found that Soldiers viewed fellow Soldiers showing symptoms of mTBI (e.g., headaches, behavioral problems, balance issues) as less operationally ready and as requiring more special accommodations than Soldiers not showing symptoms of mTBI. Furthermore, perceptions of operational readiness were not influenced differently by the types of symptoms (e.g., vestibular, cognitive, behavioral) accompanying the mTBI. Britt et al. (2015) argued that the lower perceptions of readiness for Soldiers experiencing mTBI may have been justified given the implications of TBI symptoms for Service Member performance, and that additional research should examine the performance consequences accompanying mTBI. In addition, the authors argued that if Service Members were aware of the impact their symptoms had on their evaluation by their peers and leaders, they may be more likely to get treatment for the medical problem to reduce the symptoms causing the negative evaluation.

Prior research has focused primarily on the perception of individuals with head injuries and TBI. We could uncover no research investigating how individuals interact and work with another person who is described as having a prior head injury or TBI. However, limited research

has examined the impact of interacting with someone who is believed to have a mental health problem. In general, prior researchers have argued that society treats individuals with mental illness negatively, and this treatment can directly impact their quality of life (Corrigan, 2004; Corrigan and Rao, 2012). Sibicky and Dovidio (1986) conducted an experiment to study actions and perceptions of individuals seeking psychological therapy. The researchers randomly assigned undergraduate students to either be a “target” or “perceiver” in a “getting acquainted” interaction. The students assigned the role of perceiver were informed that the target was recruited from either 1) the undergraduate participant pool, or 2) students receiving counseling at the University Counseling Center. The targets were unaware that they had been described in a particular manner to the perceiver. The results showed that the perceiver rated the targets more negatively when they were described as seeking counseling before the interaction. In addition, coders blind to condition rated perceivers as acting more negatively towards the targets when the target had been described as seeking counseling. Finally, the targets themselves were rated as performing more negatively when the perceiver thought they were seeking counseling, indicating the perceiver’s elicited behavior from the targets that confirmed their negative expectations. This study’s findings have important implications on how perceptions of individuals with mental health problems could affect interpersonal interactions and potentially team performance.

The present study was designed to assess the impact of interacting with a fellow Soldier (an experimental confederate) who had a prior head injury compared to a condition where a fellow Soldier did not have a prior injury. Participants (U.S. Army Soldiers) worked with the fellow Soldier on a computer simulation that required communication and coordination. The task used in the present study was a variant of the Distributed Dynamic Decision-Making (DDD) team task (see Lee et al., 2010, for a use of the DDD in the context of a simulated peacekeeping mission). Overall team performance on the DDD task was examined. In addition, participants completed an assessment of the Behavioral Inhibition System (BIS) and Behavioral Activation System (BAS) scales of Carver and White (1994). These measures assess whether individuals are oriented toward potential threats or opportunities in the environment.

Given the symptoms associated with having a prior head injury, we hypothesized that Soldiers would have more negative expectations of a team member who suffered from a prior head injury in comparison to a Soldier without a head injury. These expectations should be reflected in lower ratings of the partner and reduced performance of the two-person team. In addition, we expected these effects might be especially strong among individuals scoring higher on the BIS subscale of the BAS/BIS measure. People higher in BIS are more sensitive to threats in the environment (Pickering and Smillie, 2008) and therefore may be more likely to respond negatively to a partner experiencing symptoms that may compromise performance.

Methods

Participants

Participants ($N = 39$) were U.S. Army Active Duty, Reserve, and, National Guard Soldiers who were recruited from Fort Rucker, Alabama and the surrounding area via flyers and word-of-mouth. No exclusions were made based on health, gender, or ethnicity. Most participants (87

percent) were male. The mean age was 32.51 years. Although all participants in the study were fluent English speakers, 85 percent of the participants considered English their first language. Military rank was varied: 35 percent were junior-enlisted (Private to Specialist), 17.5 percent were non-commissioned officers (NCOs; Sergeant to Master Sergeant), 17.5 percent were officers (1st Lieutenant to Lieutenant Colonel), 28 percent were Warrant Officers, and 2 percent chose not to disclose rank. A wide variety of Military Occupational Specialties (MOSs) were represented in the sample, including Soldiers from combat arms (e.g., infantry, air defense), combat support (e.g., aviation, military police), and combat service support (e.g., medical, quartermaster). In terms of prior deployments, 53 percent of the sample reported previous deployment, 3 percent reported sustaining a combat-related injury, and 73 percent reported knowing someone personally who had sustained a combat-related injury.

Procedure

Upon arrival to the U.S. Army Aeromedical Research Laboratory, participants engaged in a consent process with a study investigator, wherein they were given informed consent documents that explained the purpose of the study, what would be required of their participation, and their rights as research participants. During the consent session, the participants were informed that they would be working with a partner on a task that would require them to accomplish a set of goals as a team. At this initial session, the participants learned that the purpose of the study was to measure team performance, and further details about the study and hypotheses were not disclosed. Although participants were led to believe throughout the consent session and data collection process that their task partner was another randomly-assigned Soldier, they were actually working with a one of two confederates of the study (two females who were trained members of the study team). Deception was necessary given that revealing the full hypothesis would have likely altered the behavior of the participants and therefore jeopardized the validity of the project. Before providing consent, participants were aware that they were not receiving all information related to the study, and were told that complete knowledge of the study hypotheses would potentially bias their responses. They were assured that a complete debriefing session would take place immediately following data collection.

After providing informed consent, the participant was seated at a computer in a testing room with no visual or auditory access to their partner's (the confederate's) adjoining room. The participant and confederate communicated only through a written chat function of the Distributed Dynamic Decision Making (DDD) task software (described below) used to present the study task. At the start of the task, the confederate followed a pre-written script that required casually informing the participants that they were involved in an accident during their most recent deployment and 1) sustained no injuries (no injury condition) or 2) sustained a head injury and was only recently returning to duty from a Warrior Recovery and Resiliency Center (WRRC) (prior head injury condition). Participants were randomly assigned to one of the two conditions. The participant and confederate then completed the DDD task (described below).

Once the task was complete, the participants were asked to assess their partner's performance, as well as their own perceived performance, on an evaluation survey. These performance evaluations included assessments of communication, perceived effort, quality of input, capability in accomplishing the task, and overall enjoyment of working as a team. Each statement was

rated on a Likert scale from one (strongly disagree) to five (strongly agree). After completing their evaluation surveys, participants were asked to complete a brief demographic questionnaire (age, gender, primary language, rank, and MOS) that also included information on their experiences with deployment and combat-related injuries. Participants also completed the BIS/BAS Scale to assess their motivation orientation.

Upon completion of task and questionnaires, the participants were fully debriefed by the investigators on the true study purpose and the role of the confederate. Participants had the opportunity to ask questions, and were asked to review and sign a debriefing document if they were comfortable with the research team using their data after receiving all information related to the purpose of the study. All 39 participants elected not to withdraw and to allow use of their data.

Measures

DDD task

Sociotechnical system platforms such as the DDD have been marketed as highly adaptable, and are used in a variety of research domains, including military and academia. The DDD task was developed to study various aspects of team performance, including communication in a complex and dynamic environment, through a simulation platform created by researchers at Aptima, Inc. Validation of the task has been supported by 20 years of research on human behavioral modeling, and the DDD has been used by military researchers for more than 10 years (Aptima, 2014). Besides its benefits as a research tool, the DDD can also be used for training purposes. While originally designed as a simulation of a military command and control environment, the task can be modified and tailored to a multitude of contexts, giving researchers a great deal of flexibility in terms of experimental control/manipulation. Many specific aspects of the task can be manipulated, including workload, information availability, and team structure. For the present study, the task required the participant and confederate to work together to identify and neutralize on a grid a number of “foe” targets, while protecting a number of “civilian” targets. One partner was able to see and differentiate the two types of targets; it was this person’s job to mark the foe targets. The other partner could not differentiate between targets, but had the team’s weapons; it is this person’s job to wait for the marks and then “take out” the foe target before it can neutralize any civilian targets. Throughout the task, both parties must engage in constant communication via the chat feature in order to be successful. The confederate’s performance was kept as consistent as possible for each participant (regardless of condition) by using the same technician as a confederate as often as possible, and by training all possible confederates on performance to asymptote before the beginning of the study. The primary dependent variable measured by the DDD task to represent team performance was an overall task score (a ratio of neutralized foes and remaining civilians).

Evaluation survey

Following completion of the DDD task, each participant was asked to complete a 10-item evaluation survey regarding their performance and the performance of their partner. Participants

responded to the items on a five-point scale anchored by “Strongly Disagree” and “Strongly Agree.” The following items were included for rating in the survey:

1. “The team member communicated well.”
2. “The team member put in more effort than me.”
3. “The team member was capable to accomplish the task.”
4. “The team member provided high-quality input to the task.”
5. “Overall, I enjoyed working with the other team member.”
6. “I communicated well.”
7. “I put in more effort than my team member.”
8. “I was capable to accomplish the task.”
9. “I provided high-quality input to the task.”
10. “I worked well with my team member.”

Responses were used to assess perceptions of task success and team dynamics for participants in both conditions. Items 1, 3, 4, and 5 were grouped into a scale representing *partner-evaluation* (Cronbach Alpha = 0.93), and Items 6, 8, 9, and 10 were grouped into a scale representing *self-evaluation* (Cronbach Alpha = 0.90). Item 2 was analyzed separately and reflected *partner-effort*, and Item 7 was analyzed separately and reflected *self-effort*.

BIS/BAS

The BIS/BAS Scale (Carver and White, 1994) is a 24-item self-report questionnaire created to measure dispositional motivational preferences and sensitivities. For all questions, participants rate themselves on a scale of one to four, ranging from “very true for me” to “very false for me”. Both scales have demonstrated convergent and discriminant validity, and outperformed alternate measures in predicting individual outcomes related to anticipation of punishment and/or reward (Carver and White, 1994). The BIS/BAS yields four subscale scores: BAS Drive, BAS Reward Responsiveness, BAS Fun Seeking, and an overall BIS score. All four subscales were analyzed in the present study. The Cronbach Alphas for the four scales were as follows: BAS Drive = 0.68, BAS Reward Responsiveness = 0.64, BAS Fun Seeking = 0.58, and BIS = 0.68.

Results

Data analysis strategy

One-way analyses of variance (ANOVAs) were first conducted to examine the impact of partner condition (no injury vs. prior head injury) on the overall DDD task score and the four evaluation variables (partner-evaluation, self-evaluation, partner-effort, self-effort). Correlational analyses were conducted to examine the relationships among the evaluation variables, BIS/BAS subscales, and overall score on the DDD and to assess whether these relationships were different between the no injury and probably TBI experimental conditions.

The effects of injury condition on DDD performance and evaluations

One-way ANOVAs were conducted on the overall DDD score and the four evaluation variables. The results revealed no significant effects of injury condition on any of the five dependent variables: Overall DDD Score [$F(1, 37) = 0.013$, N.S.], Partner-Evaluation [$F(1, 38) = 0.286$, N.S.], Self-Evaluation [$F(1, 38) = 0.660$, N.S.], Partner-Effort [$F(1, 38) = 1.38$, N.S.], and Self-Effort [$F(1, 38) = 0.427$, N.S.]. The means and standard deviations for the five dependent variables as a function of injury condition are provided in table 1. In terms of the evaluation variables, participants provided above-average overall evaluations of their partners and themselves, and indicated average ratings of partner and self-effort. These results indicate that military personnel do not judge a partner differently or perform differently when the partner is described as having a prior head injury in comparison to a no-injury control group.

Table 1.

Overall team DDD score and evaluation subscales as a function of injury condition.

Variable	<i>No Injury Condition</i> (<i>N</i> = 19)		<i>Prior Head Injury Condition</i> (<i>N</i> = 20)	
	Mean	SD	Mean	SD
Overall DDD Score	148.03	48.86	149.88	51.79
Partner-Evaluation	3.66	1.04	3.46	1.31
Self-Evaluation	3.50	0.91	3.25	1.03
Partner-Effort	2.70	0.91	3.10	1.11
Self-Effort	2.90	0.91	3.10	1.02

Note: No significant differences were obtained as a function of Injury Condition.

Correlations between BIS/BAS scores, evaluation variables, and DDD performance

Table 2 provides the correlations among the measured variables in the study. As seen in the table, strong correlations were obtained between participant evaluations of their partners' performance and their own performance. In contrast, ratings of self and partner effort were unrelated to one another or any of the other variables. Positive evaluations of one's own performance were positively linked to performance on the DDD, whereas evaluations of the partner's performance were not. In addition, participants who reported a greater sensitivity to punishment (greater BIS activation) achieved a lower team performance score on the computer simulation than those participants who reported a lesser sensitivity to punishment. These results are in line with theoretical expectations and connect performance on the simulation and the evaluation of that performance to an individual difference variable.

Table 2.
Correlations among the measured variables.

Variable	1	2	3	4	5	6	7	8
1. DDD Score	1.00							
2. Partner-Eval.	0.15	1.00						
3. Self-Eval.	0.35*	0.75**	1.00					
4. Partner-Effort	-0.05	0.19	-0.06	1.00				
5. Self-Effort	0.20	-0.14	0.10	0.05	1.00			
6. BAS-Reward	-0.20	-0.16	-0.18	0.02	0.12	1.00		
7. BAS-Drive	-0.06	0.12	0.20	0.10	-0.01	0.47**	1.00	
8. BAS-Fun Sk.	0.09	0.16	0.09	0.15	-0.07	0.22	0.40**	1.00
9. BIS	-0.52**	-0.26	-0.43**	0.05	-0.28	0.13	0.05	0.02

Note:

* $p < 0.05$.

** $p < 0.01$. N 's range from 39 to 40.

Besides examining the overall correlations between the variables, we also examined the correlations separately within the no injury and prior head injury experimental conditions. We consider these correlations more exploratory, given the small sample size upon which they are based (19 participants for the no injury condition and 20 participants for the prior head injury condition). A few differences in the significant correlations between the two conditions are worth noting. First, BIS scores ($r = -0.61, p < 0.01$) and ratings of partner effort ($r = -0.61, p < 0.01$) were negatively related to DDD performance only in the no-injury condition. The negative relationships were not significant in the prior head injury condition. Furthermore, BIS scores were positively related to ratings of partner effort ($r = 0.45, p < 0.01$) and negatively related to ratings of self effort ($r = -0.56, p < 0.05$) only in the no injury condition. These results suggest that individual differences in the motivational orientation of BIS were less predictive of performance and evaluations when participants were working with a partner who had a prior head injury.

Discussion

The results of the present study indicate that the team performance of military personnel on a command and control tactical simulation is not influenced by one of the team members being described as suffering a prior head injury. In addition, military personnel did not evaluate a partner described as having a prior head injury less favorably than a partner who was not described as having a prior head injury. The results did show that team performance was lower for military personnel who scored higher on the BIS subscale of Carver and White (1994) and when participants rated themselves lower on communication and coordination during the simulation. The latter findings are important, because they show self-report measures of motivational orientation and processes during the simulation were predictive of performance on the simulation in the DDD task.

One possible explanation for not finding significant negative effects of prior head injury on team performance and partner evaluation is that military personnel are familiar with problems such as TBI that can result from head trauma during military deployments. For example, the Army has mandatory training to increase awareness of TBI (Department of the Army, 2011). Military personnel may also have confidence in the treatment programs that are in place for TBI and therefore believe that if a Service Member has left one of these programs, he or she should be prepared to participate in military duties. In the present study, the partner with a prior head injury was described as returning to duty from a WRRC. Military personnel may have assumed that because the Soldier had returned from duty from a treatment facility, the Soldier would no longer be showing any symptoms from the head trauma. This finding is important, because prior research by Britt et al., (2015) showed that Soldiers evaluate fellow Soldiers as lower in operational readiness if they are currently experiencing symptoms of mTBI. The present results suggest these negative evaluations of operational readiness are not present if the Soldier is described as having returned from a treatment facility.

In terms of the findings of a negative relationship between BIS scores and performance on the DDD team task, the present results may be a function of the anxiety experienced by personnel scoring higher on the BIS subscale. Prior research has shown a positive relationship between BIS and trait anxiety (Knyazev, Slobodskaya, and Wilson, 2004). Therefore, it is possible that higher levels of anxiety interfered with the performance of personnel higher in BIS sensitivity. Interestingly, the negative relationship found between BIS sensitivity and performance was only found when personnel were working with a partner who had no prior injury. Contrary to expectations, the relationship between BIS sensitivity and team performance was not significant when personnel were interacting with a partner who had a prior head injury. These results further reinforce the lack of a prior head injury interfering with team performance.

Future research

The present results suggest that a partner having a prior head injury did not affect a two-person team's performance on a computer-based simulation task. One possibility for this lack of effect is military personnel believing in the effectiveness of treatments for medical problems that may result from head injury. Future research is needed to assess Soldier perceptions of the effectiveness of different treatments for TBI. The more confidence military personnel have in the treatment of TBI, the greater likelihood they will accept fellow unit members who have experienced head injuries but participated in treatment. Such acceptance should motivate treatment seeking among military personnel who are suffering from symptoms of TBI.

Limitations

The results of the present study should be viewed in the context of limitations of the experiment. First, although the information concerning the partner's prior medical history of a head injury was communicated to participants, it is unclear how closely the participants paid attention to the information. Participants did not often comment on the information and may have quickly forgotten the information during the simulation. Additionally, the confederate did

not disclose having a specific medical problem stemming from their prior head injury (e.g., a TBI), although the assumption of a medical problem should have been made given that the confederate had returned to active duty from a treatment center. Still, future research would benefit from clearly specifying the prior medical problem experienced by the partner when assessing the impact of different types of medical problems on team performance and evaluation. Finally, the confederate in the present study was always described to participants as a female, and therefore the results do not indicate how military personnel interact and evaluate males with and without a prior head injury. Future research should manipulate the gender of the confederate to address gender differences in evaluation.

Conclusions

In conclusion, the present study failed to find negative effects of working with a partner with a prior head injury, either in terms of performance on a team-based task or on ratings of the partner's performance during the simulation. Future research is needed on the performance-related consequences of different medical and mental health problems, and the documentation of improvement in performance outcomes when medical and mental health symptoms are reduced through participation in evidence-based treatments.

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